

In the Drawings

Please replace FIG. 4 with the corresponding figure in the Replacement Sheet.

Please add FIG. 8 as shown in the New Sheet.

No new matter is introduced by these amendments.

Attachments: FIG. 4 (Replacement Sheet) & FIG. 8 (New Sheet).

REMARKS

Please reconsider the present application in view of the above amendments and the following remarks. Applicant thanks the Examiner for carefully considering this application.

Disposition of Claims

Claims 1-12 were pending in the present application. Claims 13-24 have been withdrawn in response to the restriction requirement. Claim 3 has been cancelled by this reply. Therefore, claims 1-2 and 4-12 are pending after the amendments. Claim 1 is independent. The remaining claims depend, directly or indirectly, from claim 1.

Claim Amendments

Independent claim 1 has been amended to clarify the invention recited. Specifically, claim 1 has been amended to include a limitation in the cancelled claim 3. In addition, the two-step process is clarified. The two-step process and the tack-bond are described throughout the description, including paragraph [0041] of the published application 2004/0055152 A1. No new matter is introduced by this amendment.

In addition, claims 2, 4, 6, and 12 have been amended to clarify the invention recited or to correct antecedent problems. No new matter has been introduced by these amendments.

Claim Objections

Claim numbers have been corrected. Accordingly, withdrawal of this objection is respectfully requested.

Claim 12 was objected to due to the inclusion of “depanelizing the plurality of individual circuits.” Applicant respectfully notes that “depanelizing” a plurality of circuits from a sheet containing a plurality of circuits is well known in the art and described throughout the description. See for example, paragraphs [0011], 0013], [0015], and [0030] of the published application 2004/0055152 A1. However, in the interest of expediting the examination, claim 12 has been amended. Accordingly, withdrawal of this rejection is respectfully requested.

Drawings Objection

A new FIG. 8 is included herewith, illustrating the multiple circuits and depanelizing. No new matter is introduced as this is fully described in the originally filed application, for example in paragraphs [0011], 0013], [0015], [0030], and [0053] of the published application 2004/0055152 A1. Applicant respectfully notes that this is not an essential feature of the invention, and, therefore, a schematic illustration is sufficient. 37 C.F.R. § 83(a). A corresponding description has been added in the “Brief Description of the Drawings” section. Withdrawal of this objection is respectfully requested.

In addition, a replacement FIG. 4 is provided. The amended FIG. 4 corrects an orientation of one of the circuits 10. No new matter has been introduced by this amendment.

Rejection(s) under 35 U.S.C § 103

Claims 1, 3, 7, and 11

Claims 1, 3, 7, and 11 were rejected under 35 U.S.C. § 103(a), second paragraph, as being unpatentable over Plepys (U.S. 6,140,707) in view of Hoffmeyer (U.S. 5,757,073). Claim 3 has been cancelled, rendering this rejection moot with respect to this claim. Claim 1 has been

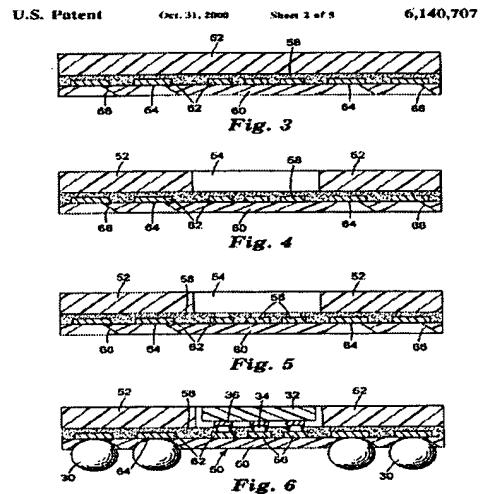
amended. To the extent that this rejection may still apply to the amended claims, it is respectfully traversed.

The present invention relates to methods for manufacturing a printed circuit bonded to a heat sink using a two-step bonding process. A method in accordance with one embodiment of the invention includes the following steps: (1) producing the printed circuit comprising at least one conductive layer circuit pattern laminated to at least one side of a dielectric layer; (2) in a first bonding step, adhering a first side of a bond film to the printed circuit by partially activating an adhesive on the bond film such that the printed circuit is tack-bonded to the bond film, wherein the adhering conforms the printed circuit to the bond film to substantially remove air entrapment between the printed circuit and the bond film; and (3) in a second bonding step, adhering a second side of the bond film to the heat sink.

Note that in the first bonding step, the printed circuit is “tack-bonded” to the bond film. Tack-bond involves an adhesive in a partially cured state, i.e., B-staged adhesive, as described in paragraphs [0040] and [0041]. Not all polymers can have a partially cured state. Examples of B-staged adhesive may include thermoplastic polyimide. (see paragraph [0041]).

In contrast, Plepys only teaches a conventional single-step bonding process (Col. 7, Lines 27-35). Specifically, Plepys fails to teach or suggests in the first bonding step, activating an adhesive on the bond film such that the printed circuit is tack-bonded to the bond film, as required by the amended claim 1.

The most significant part of Plepys is actually the removal of the stiffener/heat sink from the area adjacent to the hot silicon chip (see drawing to the right). Plepys claims that this is advantageous because (a) the resultant shrinkage of the higher-CTE polymer adhesive (58) and tape (60) materials after the removal of the stiffener/heat sink (52) makes that exposed area very planar, which enhances the soldering of the chip, and (b) mounting the exposed chip (32) on the same side as the stiffener/heat sink (52) allows an additional heat sink to be applied directly to the chip from above. Note that without this additional heat sink (not shown) the cooling capabilities of the Plepys construction would be poor: the heat from the chip would have to travel into the copper (56) on the tape below, and then spread in the X-Y plane of the circuit (60) and up through the adhesive (58) to reach the stiffener/heat sink.



Hoffmeyer fails to teach or suggest that which is missing in Plepys. Hoffmeyer discloses a method of facilitating rework of an electronic component – the component is adhered to a thin metal foil surface that is pre-bonded with adhesive to the heat sink. The component can then be removed without damaging the surface of the heat sink. Specifically, Hoffmeyer does not teach a two-step process that involves in the first bonding step, activating an adhesive on the bond film such that the printed circuit is tack-bonded to the bond film, as required by the amended claim 1.

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the

knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). *See also*, M.P.E.P. § 2142.

Because neither Plepys nor Hoffmeyer discloses all limitations of the amended claim 1, a combination of Plepys and Hoffmeyer cannot render the amended claim 1 unpatentable. Dependent claims 7 and 11 should also be patentable for at least the same reasons. Accordingly, withdrawal of this rejection is respectfully requested.

Claims 1-12

Claims 1-15¹ were rejected under 35 U.S.C. § 103(a), second paragraph, as being unpatentable over Fraivillig (U.S. 6,015,607) in view of Hoffmeyer (U.S. 5,757,073). Claim 3 has been cancelled, rendering this rejection moot with respect to this claim. Claim 1 has been amended. To the extent that this rejection may still apply to the amended claims, it is respectfully traversed.

Fraivillig '607 patent discloses *single-step methods* for making flexible laminates using a polyetherimide or a siloxane polyetherimide copolymer. (Abstract). The polyetherimide or siloxane polyetherimide used in Fraivillig '607 patent is incapable of being B staged, i.e., it cannot be partially cured because they will be fully cured upon activation. Specifically, Fraivillig '607 patent does not teach a two-step process that involves in the first bonding step, activating an

¹ Applicant assumes this is claims 1-12 because claims 13-15 have been withdrawn.

adhesive on the bond film such that the printed circuit is tack-bonded to the bond film, as required by the amended claim 1.

As noted above, Hoffmeyer also fails to teach or suggest the same limitation. Therefore, a combination of Fraivillig and Hoffmeyer cannot render the amended claim 1 unpatentable. Dependent claims 2 and 4-12 should also be patentable for at least the same reasons. Accordingly, withdrawal of this rejection is respectfully requested.

Conclusion

Applicant believes this reply is fully responsive to all outstanding issues and places this application in condition for allowance. If this belief is incorrect, or other issues arise, the Examiner is encouraged to contact the undersigned or his associates at the telephone number listed below. Please apply any charges not covered, or any credits, to Deposit Account 50-0591 (Reference Number 07009/011003).

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Respectfully submitted,

By


T. Chyau Liang, Ph.D.
Registration No.: 48,885
OSHA · LIANG LLP
1221 McKinney St., Suite 2800
Houston, Texas 77010
(713) 228-8600
(713) 228-8778 (Fax)

Attachments: Replacement FIG. 4
New FIG. 8